An Auto-Configuration System for the GMSEC Architecture and API

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Agenda

- The Goddard Mission Services Evolution Center (GMSEC)
- Automated Configuration Concept
- Implementation Approach
- Key Components and Benefits

GMSEC

- The Goddard Mission Services Evolution Center (GMSEC) was established in 2001 as an evolutionary approach to ground system architectures

- Objectives
  - Simplify integration and development using a Plug and Play approach
  - Facilitate technology infusion over time
  - Support evolving operational concepts
  - Avoid vendor lock-in

- Key Concepts
  - Standardize interfaces – not components
  - Provide a middleware infrastructure
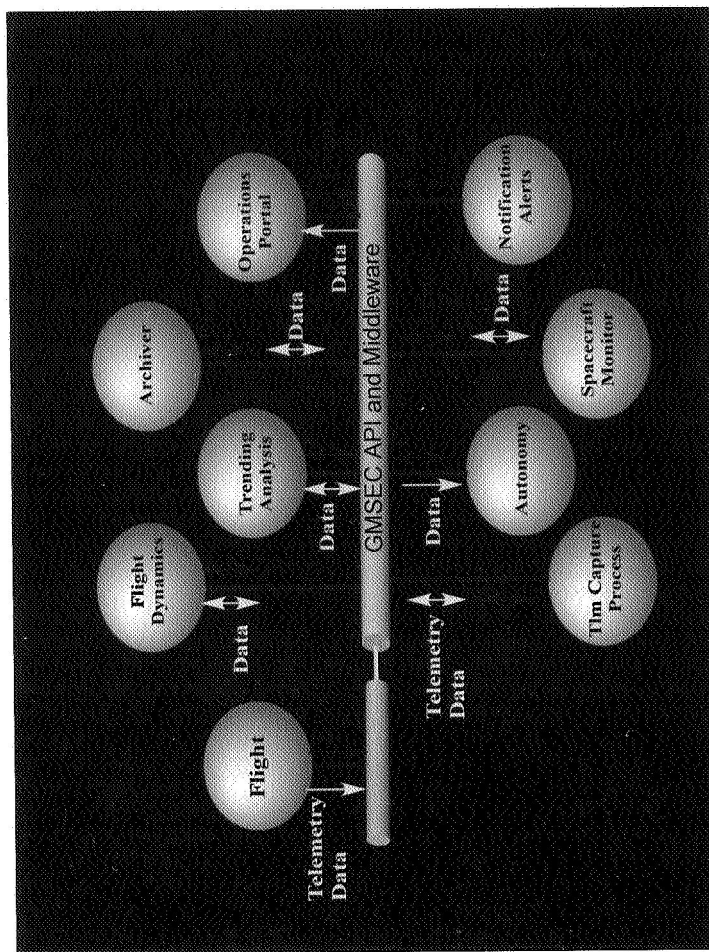 - Allow customers to select components that meet their needs

GMSEC Ground System Architecture
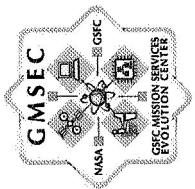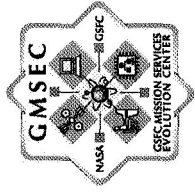
Traditional Design
Socket Connections
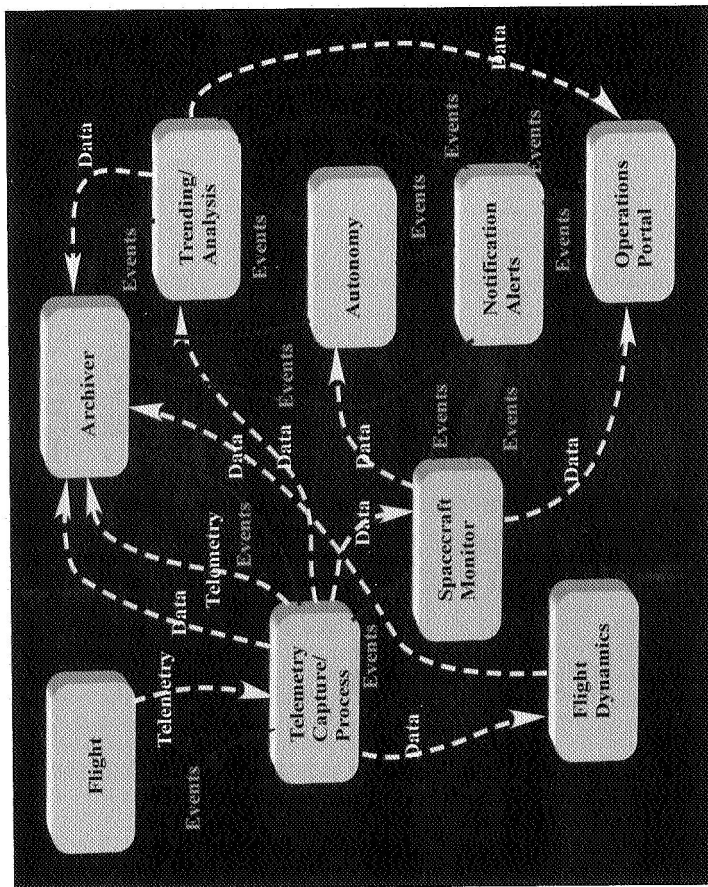
GMSEC Design
Middleware Connections

GMSEC API and Middleware

Middleware simplifies integration by having components interface to a bus and not to each other

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GMSEC API

- Application Program Interface (API)
  - Provides connection between application components and architecture middleware
  - Typically implemented as a function library
  - One API implementation per language

- Encapsulate messaging transport
  - Single API for multiple middlewares
  - Flexibility for middleware additions
  - Platform and operating system independence

- Abstract messaging structures
  - Simple message model
  - Facilitates data packaging
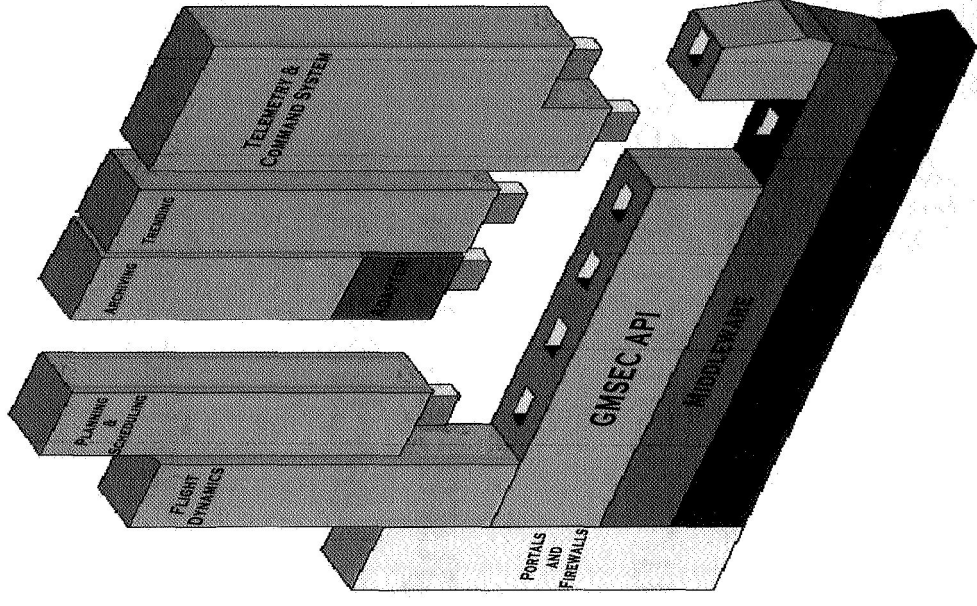
Extending GMSEC Concepts through Automated Configuration

- Currently, configuration of a GMSEC-based system requires separate configuration for every component

- An automated, centralized configuration will provide for easier management of architecture components

  - Define a standard for managing the configured content

  - Facilitate reconfiguration of components
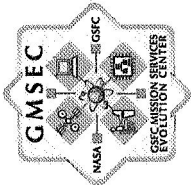
  - Allow faster configuration for new missions
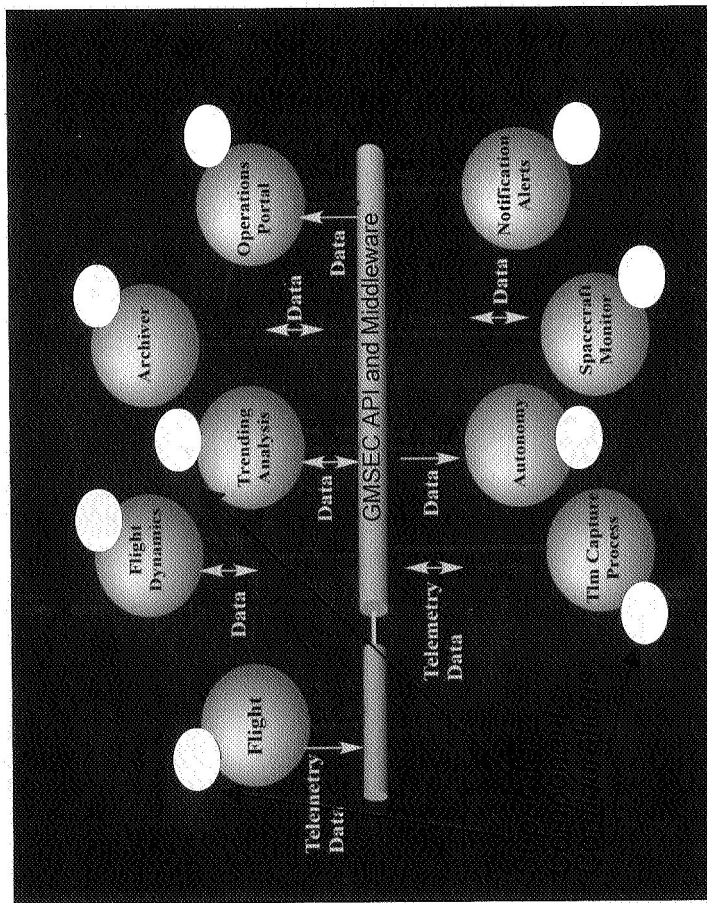
Drivers

- The Automated Configuration System must
  - Be platform and language independent
  - Provide a standard data representation format
  - Provide an efficient data representation format
  - Support client/server and server/server communications
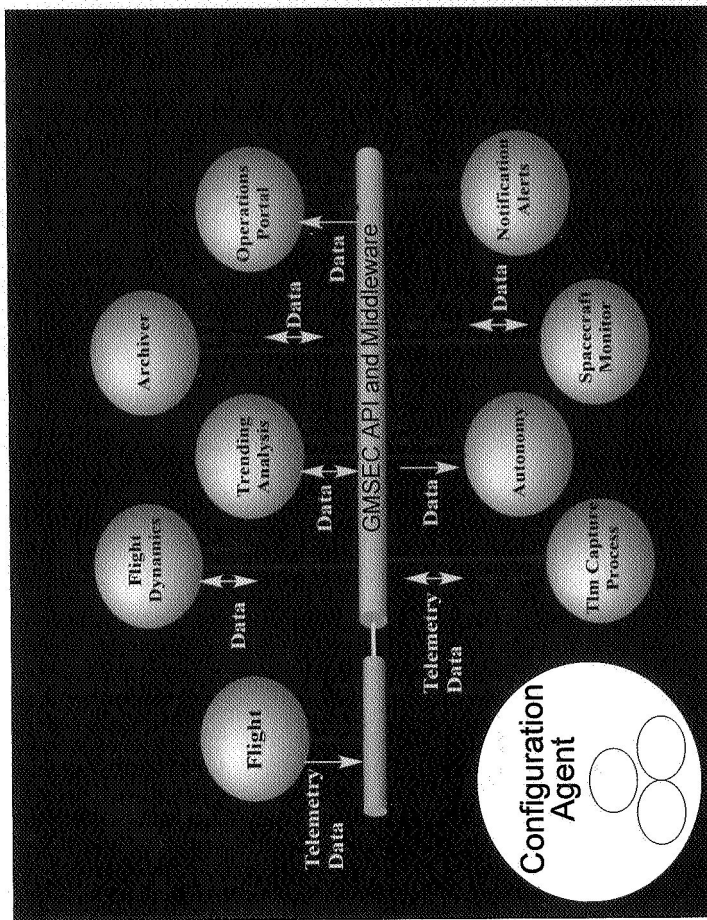 - Provide broadcast capability

GMSEC Ground System Configurations
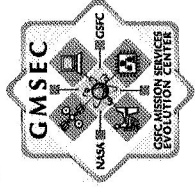
Current GMSEC Configuration

Automated GMSEC Configuration

Centralized configuration agent simplifies integration by having components interface to a single configuration point

Impact to Communication Layers

Auto-configuration approach affects the top four layers of the Open Systems Interconnect (OSI) model

– Application Layer
  - Provides service to end user
  - Impacts the GMSEC API

– Presentation Layer
  - Provides data representation
  - Impacts data packing definitions

– Session and Transport Layers
  - Provides connection/data format
  - Impacts protocol selection

- 7 Application — web, mail, ...
- 6 Presentation — encoding, compression
- 5 Session — Connection
- 4 Transport — TCP, UDP
- 3 Network — Routers
- 2 Datalink — Switches
- 1 Physical — Hubs
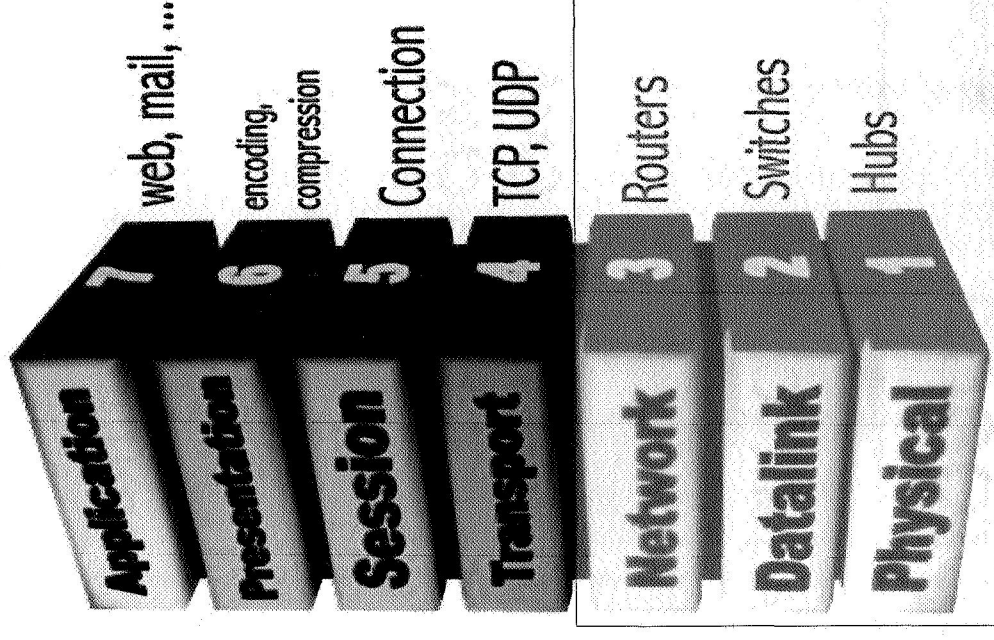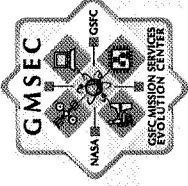
Implementation Approach

- Create a Configuration Management Agent (CMA)
  - Implemented as a GMSEC component
  - Manages configuration files

- Enhance GMSEC API to automatically interact with CMA
  - Provides a transparent way to retrieve configurations from CMA

- Create a lightweight middleware
  - Limited to required features
  - Facilitates communication between API and CMA

- Include both TCP and UDP to meet communication requirements
  - TCP for clients
  - UDP for inter-server (broadcast)

Auto-Configuration System Diagram

GMSEC Message Bus

CMA

MBServer

UDP Broadcast

MBServer

Temporary TCP connection

New GMSEC component

GMSEC component

GMSEC component

COTS Mission GMSEC Bus
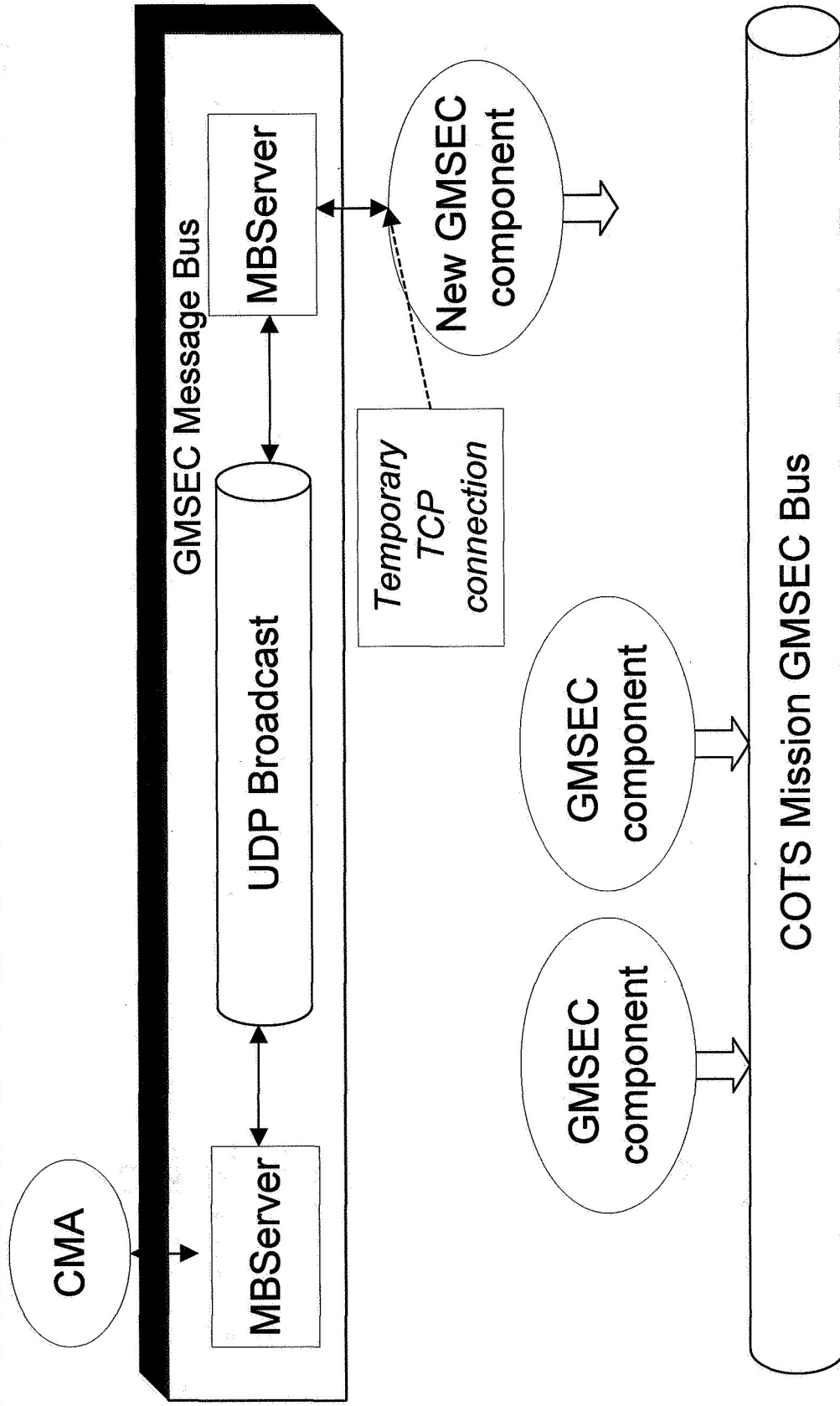
Key System Components

- Configuration Management Agent
  - Holds component configurations
    - Middleware options
    - Message formats
    - Component specific options
  - Responds to configuration requests

- Enhanced GMSEC API
  - Retrieves component configuration from CMA
  - Provides the interface to component developer

- GMSEC Message Bus as the middleware solution
  - Self-configuring, hub and spoke middleware
  - Supports inter-server communication
  - Bridges CMA and GMSEC API enhancement

Although designed as an integrated system, components can also be used independently

Benefits of the Auto Configuration Approach

- Significant reduction in integration time

- Components added/upgraded/migrated without impacting existing system

- Standard configuration approach provides reuse of configuration specs between different missions

- Vendors can build on the configuration definition standards to more easily integrate their products into the NASA ground system domain

Summary

- The GMSEC architecture provides a scalable, extensible ground and flight system approach for future NASA missions, enabling easy integration of components to meet customer requirements

  - Open source download at http://opensource.gsfc.nasa.gov

- The Auto Configuration System expands on GMSEC's service oriented architecture by providing further integration and configuration capabilities

  - Currently being deployed to component developers

Acronym List

API	Application Program Interface
CMA	Configuration Management Agent
COTS	Commercial Off The Shelf
GMSEC	Goddard Mission Services Evolution Center
GSFC	Goddard Space Flight Center
ICS	Interface & Control Systems
MB	Message Bus
OSI	Open Systems Interconnect
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

Questions?

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